

SOARCA Briefing November 16 2007.

Consultant's report. Graham Wallis November 25 2007

General

The staff has done a good job within the constraints imposed by the Commission.

This important study should not be published until it is clear that the results are firm, robust, reliable and justifiable. Implications should be carefully thought out. When the study is published, it needs to be clear that information and results have not been held back but have been made explicitly available. This includes an open discussion and evaluation of the effects of assumptions made in the analysis and of how realistic these assumptions are.

While some technical details, such as containment leak rates and the feasibility of some hypothesized actions, need more complete analysis, key questions appear to involve the overall approach to several high level issues.

CDF Screening criterion

The staff used a screening criterion for CDF of $10E-6$ /yr, as requested by the Commission.

This starting assumption seems to have had the effect of screening out most, if not all, events that have significant public consequences.

As frequency decreases, the number of events tends to increase, particularly with more complete PRAs, as there are many very unlikely scenarios that can be imagined. In the Technology Neutral Framework study (NUREG-1860) Appendix E contains a study of an existing LWR plant. A long list of accident sequences is developed. Those with a 95th percentile frequency of less than $1E-7$ /yr are discarded, though these are the ones that lead to significant fatalities and cancers. While the events that are retained meet the latent cancer QHO, the many that are screened out, when added up, fail to meet this criterion by a factor of about five. It could be argued that the screening approach is therefore inappropriate, as it discards the significant contributors to public risk and gives a false measure of conformance with the criteria.

Even if very unlikely events of significant consequence are screened out, there is a need to explain the analysis of these events and why it is realistic to exclude them.

The public is inclined to be interested in the likelihood of events that are harmful. The SOARCA study may not be appreciated if it appears only to include events that are not harmful.

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When all significant events have a predicted frequency of $1\text{E-}6/\text{yr}$ or less, the most likely future event of consequence is probably one that has not been anticipated nor analyzed (e.g. Davis-Besse proceeding to a LOCA that disables the scram system). Experience with previous significant events indicates that sequences driven by human cognitive or deliberate error are prime candidates. "Operator error" is already a significant contributor to risk from internal events in the SOARCA study. Can suitable technical design and mitigative measures reduce the effects of inappropriate human actions? Can these effects be quantified?

The staff's response to an internal review that recommends the identification of significant contributors to *risk* is dismissive. Is a $1\text{E-}8/\text{yr}$ event that kills $1\text{E}4$ people less significant than a $1\text{E-}6/\text{yr}$ event that kills 10 people, though in terms of risk it is ten times greater? Since predicting frequencies in the range of $1\text{E-}8/\text{yr}$ is unlikely to be performed across the board with much confidence, shouldn't there be some assurance of "defense in depth" (e.g. a low containment failure probability) in case the predictions of these low CDFs are off by a large factor?

Dose and health effects

The assumptions that are made about health effects of radioactivity are key as they can have a very large effect on the conclusions. It is probably advisable to include a fair comparison of what the conclusions would be under various assumptions, as this would be done by perceptive readers anyway.

The report should include a discussion of the various competing assumptions and a justification of which is the "best estimate". A draft SECY paper prepared after our meeting attempts to do this, but it seems designed to convince the Commission rather than to establish public credibility.

A dose threshold for latent cancer fatalities of $5\text{rem}/\text{yr}$ is three orders of magnitude above what the agency has already published as the overall dose equivalent to the latent cancer QHO ($2\text{E-}6$ cancers/yr divided by $5\text{E-}4$ cancer/rem = $0.004\text{rem}/\text{yr}$). A change to twenty-year established policy that appears to reduce the criterion for significant effects of radioactivity by a factor of 1000 is extraordinary. It is likely to be received with skepticism and probably with headlines in newspapers. In other areas of public radioactivity protection, such as medical diagnosis and treatment, the trend has been to make requirements stricter. Is there some new and convincing scientific evidence for the change? How much influence does this change have on the results? How will this be explained to the public and inspire confidence?

Evacuation

Much depends on successful evacuation.

Since seismic events appear to dominate the results, evacuation following a seismic event should be analyzed realistically, even if this impacts previous regulatory decisions. Damage to evacuation routes, vehicles and communications are examples of influences to consider.

Even without seismic complications, there are opportunities for confusion and misinformation to retard evacuation. Concurrent events, such as snowstorms, would also influence mobility. Scenarios may appear optimistic.

Mitigation

One of the most useful results of this study is the evaluation of the effectiveness of mitigation. It would be helpful to separate out the various contributors in reducing consequences, with assessment of the value and uncertainties associated with each.